Training your brain on a tablet

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Publication date:
2012

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ONLY recently it has become possible to combine wireless consumer neuroheadset and portable devices such as smartphones or tablets into neuroimaging devices [1]. Using these devices for neurofeedback training might potentially allow for broader usage and go beyond the constraints of traditional lab settings, making it possible to extend training sessions over long periods in mobile everyday context. Neurofeedback training can help individuals to control activity in specific brain frequencies by providing a live feedback of the changes in power within e.g. the 8-12 Hz alpha band. It can potentially lead to improvement of cognitive performance and neurofeedback training has been used in many studies as part of treatment for people with mental disorders such as attention deficit hyperactivity disorder (ADHD), epilepsy [2], alcohol abuse, and post-traumatic stress disorder (PTSD)[3]. However simple neurofeedback interfaces using a vertical scale implemented merely for conducting experiments with little focus on the user experience may result in interfaces, which in spite of indicating the cortical activity ends up not facilitating control but rather having a disturbing effect, causing less effective neurofeedback training.

Initially we replicated a previous study[4] using the changing color of a square as neurofeedback (figure 1A), in a setup with a 16 channel emotiv EEG neuroheadset connected with a USB-dongle to an android tablet [1] involving 7 males and 5 females (age 23.8 ± 1.8) training to increase their upper alpha frequencies in 5 x 5 minutes sessions from Monday to Friday during one week (fig 1B, blue curve). Subsequently we debriefed the subjects to infer what strategies were applied to increase their alpha brain wave activity. A number of common strategies appeared to involve imagining continuous motion like running, or repetitive actions executed in sequential order to create a smooth flow. Coupled with an awareness of the body expressed by the senses or supported by visual memories framed within a personal perspective.

With point of departure in these findings a new experiment was designed with focus on user experience, in order to not only visualizes the brain activity, but incorporate colors in a spatio-temporal structure to better support individual associations. The visualization is generated by squares of different colors which build up vertical columns over seconds when the subject increases the activity above baseline level, forming a horizontal outline of the alpha activity over a 5 minutes session. Depending on the individual's ability to increase the activity of upper alpha band, the pattern is generated either in a continuous or sequential manner (fig. 1C). This interfaces was tested with 13 subjects (age 23.6± 2.0) and compared to the previous experiment, we found a significant difference in the ability to increase activity in both lower an upper alpha band during the training (figure 1B yellow curve).

These results indicate that taking a user experience driven approach to the interface design may provide subjects with a greater sense of control and thereby enhance the effects of neurofeedback training in future mobile EEG applications.

Figure 1A

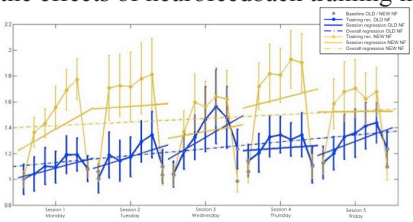

Figure 1B

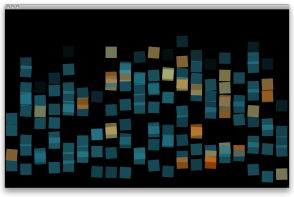

Figure 1C

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